TABLE 2

GROSS PRIVATE DOMESTIC PRODUCT AND FACTOR OUTLAY, 1952-1973 (BILLION CURRENT LIRE)

Year	1. Gross Private Domestic Product	2. Investment Goods Product	3. Consumption Goods Product	4. Inventory Goods Product	5. Net Export Product	6. Labor Compensation	7. Property Compensation
1952	10004.5	2562.6	7809.9	4.0	-372.0	5812.1	4192.3
1953	11121.0	2852.3	8459.7	82.0	-273.0	6449.9	4671.1
1954	11752.9	3070.5	8823.4	6.0	-147.0	7120.9	4632.0
1955	12934.8	3423.7	9431.2	228.0	-148.0	7725.8	5209.0
1956	14035.5	3740.4	10293.1	187.0	-185.0	8441.2	5594.4
1957	15119.1	4184.7	10906.4	152.0	-124.0	9067.9	6051.2
1958	16192.2	4315.0	11562.1	159.0	156.0	9683.9	6508.2
1959	17216.8	4642.7	12056.1	206.0	312.0	10205.1	7011.7
1960	18806.8	5309.5	13076.3	407.0	14.0	11110.0	7696.8
1961	20933.6	6092.3	14224.3	529.0	88.0	12182.6	8751.0
1962	23685.7	7088.7	16171.0	486.0	-60.0	13854.6	9831.1
1963	26959.5	8415.0	18813.5	416.0	-685.0	16471.4	10488.1
1964	29665.5	8472.6	20767.0	233.0	193.0	18409.5	11256.0
1965	31124.2	7962.2	21686.9	311.0	1164.0	19142.6	11981.6
1966	33854.1	8520.4	23869.7	387.0	1077.0	20442.9	13411.2
1967	37450.6	9678.6	26366.0	634.0	772.0	22845.7	14604.9
1968	40506.0	10755.2	28240.6	80.0	1430.0	24681.0	15825.0
1969	45360.5	12260.1	31443.5	452.0	1205.0	27023.6	18336.9
1970	51287.6	14183.2	35836.4	909.0	359.0	32104.8	19182.8
1971	54327.5	15060.4	37990.1	255.0	1022.0	36302.3	18025.2
1972	59471.0	16242.2	41820.8	480.0	928.0	39779.3	19691.7
1973	72026.0	20256.3	51786.8	1586.0	-1603.0	48350.7	23675.3

$$\bar{W}_{it} = \frac{1}{2} W_{it} + \frac{1}{2} W_{i,t-1} \; ; \quad W_{it} = \frac{p_{it}q_{it}}{\sum_i p_{it}q_{it}} .$$

The series for q_t itself is then constructed by setting it equal to the current dollar value ($p_t q_t$) in the base year. We use 1963 as the base year for all our quantity indexes.

It is convenient to have the product of price and quantity indexes equal to the value of transactions so that standard accounting identities hold for variables defined as price and quantity index numbers. Accordingly, we construct discrete Divisia price indexes as the value in current prices divided by the discrete Divisia quantity index

$$p_t = \frac{\sum p_{it}q_{it}}{q_t} .$$

The resluting price indexes are approximately equal to the Divisia price indexes.

We proceed to construct price and quantity indexes for total product and its components using the Divisia aggregation procedure described above. We first construct separate quantity indexes for purchases of investment goods by the private domestic sector and the government sector. The quantity index of private domestic purchases of investment goods is a Divisia index of (1) nonresidential structures, (2) machinery and equipment, (3) residential structures, and (4) consumer durables. The quantity index of general government purchases of investment goods is a Divisia index of structures and producer durable equipment. The quantity index of domestic final sales of investment goods is then constructed as a Divisia index of the quantity indexes for the private domestic and general government sectors.

The quantity index of consumer purchases of goods and services is a

Divisia index of (1) nondurable goods and services as defined in the national income accounts, and (2) our imputation for consumer durable services. The quantity index of general government net purchases of consumption goods from the business sector is computed by subtracting general government GNP from current government expenditures, both in constant prices. The quantity index of domestic final sales of consumption goods is then constructed as a Divisia Index of the quantity indexes for the consumer and general government sectors and subtracting out rest of world GNP.

The quantity index of domestic final sales is constructed as a Divisia quantity index of the quantity indexes of domestic final sales of (1) investment goods, (2) consumption goods, and (3) changes in business inventories. Net exports are excluded from this Divisia Index because they take on negative values over the time period in question. Finally, the quantity index of gross private domestic product is constructed by adding the quantity indexes of (1) domestic final sales, and (2) net exports.[2]

Approximate Dvisia price indexes corresponding to all of the above defined quantity indexes are computed by dividing the current dollar values by the quantity indexes. Since the quantity indexes are all constructed such that they equal the current dollar values in 1963, our aggregate price indexes all equal unity in 1963. Price and quantity indexes for gross private domestic product are presented in Table 3.

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[2] We sum these quantity indexes rather than use the Divisia index procedure since net exports can be negative. Our Divisia index procedure requires taking logarithms. If a quantity series can take negative values, the indexing procedure is not well-defined.

TABLE 3

GROSS PRIVATE DOMESTIC PRODUCT AND FINAL SALES, ITALY 1952-1973 (CONSTANT LIRE of 1963)

Year	1. Gross Private Domestic Product Price Index	2. Gross Private Domestic Product Quantity Index	3. Consumption Goods Product Price Index	4. Consumption Goods Product Quantity Index	5. Investment Goods Product Price Index
1952	.728	13734.1	.697	11208.0	.824
1953	.742	14989.3	.713	11871.0	.819
1954	.756	15539.3	.726	12152.2	.810
1955	.767	16870.0	.736	12645.4	.818
1956	.794	17685.6	.780	13204.3	.836
1957	.817	18505.1	.807	13522.3	.866
1958	.827	19575.9	.811	14261.0	.870
1959	.824	20887.0	.809	14908.4	.866
1960	.844	22274.0	.830	15751.3	.880
1961	.864	24220.5	.851	16720.8	.895
1962	.921	25720.9	.916	17656.0	.938
1963	1.000	26959.5	1.000	18813.5	1.000
1964	1.064	27888.4	1.059	19607.2	1.069
1965	1.079	28852.5	1.081	20054.4	1.074
1966	1.110	30499.5	1.126	21195.4	1.095
1967	1.142	32807.7	1.158	22760.5	1.113
1968	1.169	34656.9	1.189	23755.0	1.139
1969	1.231	36833.7	1.250	25163.7	1.204
1970	1.321	38821.5	1.320	27156.2	1.334
1971	1.437	37812.0	1.443	26332.5	1.437
1972	1.529	38685.5	1.552	26938.1	1.524
1973	1.743	41321.7	1.820	28454.1	1.771

TABLE 3 (continued)

Year	6. Investment Goods Product Quantity Index	7. Inventory Goods Product Price Index	8. Inventory Goods Product Quantity Index	9. Net Exports Goods Product Price Index	10. Net Exports Goods Product Quantity Index
1952	3111.2	1.000	4.0	1.303	-269.0
1953	3481.3	.965	85.0	1.252	-218.0
1954	3788.7	.462	13.0	.936	-157.0
1955	4183.1	.938	243.0	.974	-152.0
1956	4474.2	.974	192.0	1.480	-125.0
1957	4830.8	.974	156.0	-2.296	54.0
1958	4958.2	.909	175.0	.629	248.0
1959	5363.0	.880	234.0	.712	438.0
1960	6030.8	.923	441.0	.189	74.0
1961	6807.7	.955	554.0	.633	139.0
1962	7560.6	.970	501.0	-30.000	2.0
1963	8415.0	1.000	416.0	1.000	-685.0
1964	7927.9	1.064	219.0	1.340	144.0
1965	7415.1	1.111	280.0	1.047	1112.0
1966	7781.4	1.281	302.0	.876	1229.0
1967	8692.8	1.510	420.0	.851	929.0
1968	9442.1	1.143	70.0	.885	1616.5
1969	10182.5	1.444	313.0	.894	1348.1
1970	10632.4	1.204	755.0	.807	444.6
1971	10484.0	1.321	193.0	1.039	983.7
1972	10660.6	1.486	323.0	.805	1153.4
1973	11435.3	1.563	1015.0	-2.497	642.1

TABLE 3 (continued)

Year	11. Relative Share of Investment Goods
1952	.247
1953	.252
1954	.258
1955	.266
1956	.267
1957	.277
1958	.272
1959	.278
1960	.289
1961	.300
1962	.305
1963	.309
1964	.290
1965	.269
1966	.263
1967	.269
1968	.276
1969	.281
1970	.284
1971	.284
1972	.280
1973	.281

4. Price and Quantity Index Numbers for Total Factor Input

We would like to use the same Divisia aggregation procedures to construct a quantity index of total input as we did to construct aggregate output. It is possible to construct a Divisia index of the aggregate input of capital services, but there is insufficient data available to carry out a similar procedure for labor services. It would be desirable to distinguish among different categories of labor classified by sex, number of years of schooling, occupation, age and so on. However, earnings data cross-classified with these characteristics are not available.

Following Jorgenson and Griliches (1967), our quantity index of labor input is a product of total persons employed, average hours worked per person employed, and a quality index based on the educational composition of the labor force.

To construct our quality index we use information on the educational composition of the labor force from the Ninth Census of Italy for 1951 and from the OECD publication Reviews of National Policies for Education, Italy, for 1960, 1963, 1966. We present the composition for these four years in Table 4. We use earnings weights taken from Denison (1967). We expand Denison's weights for education to the level he suggests is appropriate if age and sex classifications are not used in the labor quality index. We present the earnings figure in Table 4. In Table 5 we present our computation of the annual percentage changes in our quality index of labor input. We multiply average hours per man times employment, times the index of educational attainment to obtain our quantity index of labor input. The implicit price of labor services is computed by dividing our estimate of total labor

TABLE 4

PROPORTION OF ACTIVE POPULATION BY HIGHEST YEAR OF SCHOOL COMPLETED

Years of Schooling	1951	1960	1963	1966	Weights of Educational Attainment
0 - 2	23.7	31.6	25.3	20.3	16.67
3 - 7	64.3	51.5	55.5	57.2	55.43
8 - 11	6.2	9.4	11.0	13.4	107.33
12 - 15	3.9	5.2	5.8	6.3	181.30
16+	1.8	2.3	2.4	2.8	256.67

Sources:
1) 1951: derived from the Ninth Census of Italy, 1951, Volume 7, p. 309
2) 1960-1963-1966: OECD, Reviews of National Policies for Education, p. 35. Denison's allocation of years of schooling by degree for 1951 (Why Growth Rates Differ, p. 398) has been collapsed into broader categories.
3) Income weights are taken from Denison using the full differential between educational groups.

TABLE 5

RELATIVE PRICES*, CHANGES IN THE DISTRIBUTION OF THE LABOR FORCE, AND INDEXES OF LABOR-INPUT PER MANHOUR, ITALIAN LABOR FORCE

School year completed	p'	Δe	p'	Δe	p'	Δe
	1951-60		1960-63		1963-66	
0 - 2	.285	7.9	.272	-6.3	.253	-5.0
3 - 7	.946	-12.8	.904	4.0	.843	1.7
8 - 11	1.832	3.2	1.750	1.6	1.632	2.4
12 - 15	3.095	1.3	2.955	0.6	2.757	0.5
16+	4.381	0.5	4.184	0.1	3.903	0.4
Percentage change in Labor Input per Manhour	.0222		.0689		.0703	
Annual Percentage Change	.0025		.0230		.0234	

* The relative prices are computed using the appropriate mean period distribution of the labor force as weights.

compensation by the quantity index of labor input. In Table 6 we present annual estimates for (1) total employment, (2) the index of educational attainment, (3) average annual hours per person employed, (4) the price index of labor input, and (5) the quantity index of labor input.

The starting point for a quantity index of capital input is a perpetual inventory estimate of the stock of each type of capital, based on past investments in constant prices. At each point of time, the stock of each type of capital is the sum of stocks remaining from past investments of each vintage. Under the assumption that efficiency of capital goods declines geometrically, the rate of replacement, say δ, is a constant. Capital stock at the end of every period may be estimated from investment and capital stock at the beginning of the period:

$$K_t = A_t + (1 - \delta)K_{t-1} ,$$

where K_t is end of period capital stock, A_t the quantity of investment, and K_{t-1} the capital stock at the beginning of the period.

For each type of capital included in our accounts, we prepare perpetual inventory estimates of the stock as follows: First, we obtain a benchmark estimate of capital stock from data on national wealth in constant prices. Second, we deflate the investment series to obtain investment in constant prices. Third, we choose an estimate of the rate of replacement. Finally, we estimate capital stock in every period by applying the perpetual inventory method described above.

We construct capital stock estimates for six distinct classes of assets: (1) nonresidential structures, (2) machinery and equipment, (3) inventories, (4) residential structures, (5) consumer durables, and (6) land. All of our

TABLE 6

PRIVATE DOMESTIC LABOR INPUT, 1952-1973 (CONSTANT LIRE of 1963)

Year	1. Private Domestic Persons Engaged (Billions)	2. Educational Attainment Per Person (Index)	3. Private Domestic Hours Per Person (Thousands Per Year)	4. Private Domestic Labor Input, Price Index	5. Private Domestic Labor Input, Quantity Index
1952	18674	.915	1.016	.461	12616.8
1953	18865	.917	1.025	.496	13009.2
1954	19121	.919	1.037	.530	13440.3
1955	19046	.922	1.030	.573	13491.3
1956	19063	.924	1.018	.626	13475.8
1957	19106	.926	1.023	.653	13894.9
1958	19134	.929	1.014	.694	13959.5
1959	19100	.931	1.025	.714	14285.1
1960	19025	.933	1.039	.739	15035.0
1961	19016	.955	1.028	.780	15608.7
1962	18734	.977	.997	.875	15833.4
1963	18363	1.000	1.000	1.000	16471.4
1964	18269	1.024	.954	1.147	16048.5
1965	17860	1.048	.900	1.272	15049.3
1966	17522	1.073	.925	1.309	15618.1
1967	17709	1.098	.931	1.392	16412.3
1968	17639	1.124	.930	1.457	16943.7
1969	17672	1.151	.893	1.586	17021.0
1970	17663	1.178	.893	1.819	17651.9
1971	17590	1.206	.862	2.074	17502.3
1972	17294	1.234	.837	2.285	17405.2
1973	17422	1.264	.813	2.731	17703.5

investment data in current and constant prices is derived from the Annuario di Contabilita Nazionale, published by ISTAT. This also provides investment data for the general government which we subtract from total investment figures to derive private domestic sector investment.

We use the deflators implicit in our investment data as estimates of the asset deflators for all assets except for inventories, where the investment deflators are very erratic. We use a wholesale price index taken from Il Vabre Lire dal 1961 al 1972 (ISTAT), as the inventory asset deflator, We assume that the stock of land is constant, which implies zero investment.

We take benchmarks for residential structures, nonresidential structures, and machinery and equipment from La Formazione del Capitale in Italia by Ornello Vitali. Our benchmark for total inventories is taken from "Evaluations of Italian National Wealth in the last Fifty Years" by A. Giannone, in the Banca Nazionale del Lavoro Quarterly Review of December 1963. We estimate our consumer durables benchmark.

Our estimate for the value of private land is derived from data given in Sintesi Statistica di Un Ventennio di Vita Economica Italiana by Giuseppe de Meo, in Annali di Statistica (1973). We use his figures for the value of land in agriculture. To estimate the value of land in the remaining sectors we use de Meo's assumption that the value of non-agricultural business sector land is 10% of the value of non-residential construction and residential land is 15% of the value of residential structures.

The study cited above by Giuseppe de Meo provides estimates for median lifetimes of various asset types in several sectors of the Italian economy. We estimate our rates of replacement for producer durable equipment, residential structures, and non-residential structures on the basis of that information

after some experimentation. We follow Christensen and Jorgenson (1969) in using .2 as our replacement rate for consumer durables -- on the assumption that the U.S. rate is also applicable to Italy. The benchmarks, replacement rates, and deflators are summarized in Table 7. Price indexes for each asset class for 1952-1972 are given in Table 8.

We assume that the real flow of services from each type of asset is proportional to its stock. To construct an aggregate quantity index of capital input we must weight each type of real service flow by its share in the total value of capital input. Thus we must construct a service price for each asset, which when multiplied times the corresponding stock yields the value of the service flow for each type of asset. We follow Christensen and Jorgenson (1969) in the specification of capital service prices. The specification of service prices requires explicit treatment of taxes. For tax purposes the Italian private domestic sector can be divided into business enterprises and households. The household sector is not subject to direct taxes on the capital service flow from its assets. Business enterprises however, are subject to such direct taxation. In order to take this difference into account, we must allocate the stock of residential structures between households and business enterprises and create distinct service prices for each.

Using the imputation for owner-occupied rent given in the Annuario di Contabilita Nazionale and the data on total rent in OECD, National Accounts, we compute owner-occupied implicit rent as a proportion of total rent. We use these proportions to allocate our stock of residential structures between households and business enterprises. We estimate that the value of owner-occupied residential real estate attributable to land is 15% of the value of owner-occupied residential structures. The rest of our total land stock is allocated to business enterprises.

TABLE 7

BENCHMARKS, RATES OF REPLACEMENT, AND PRICE INDEXES EMPLOYED IN ESTIMATING CAPITAL

Asset Class	1963 Benchmark (Billions of 1963 Lire)	Replacement Rate	Deflator
1. Consumer Durables	6,369	0.200	Implicit Deflator, ACN*
2. Non-residential structures	13,046	0.040	Implicit Deflator, ACN
3. Producer Durables	17,099	0.111	Implicit Deflator, ACN
4. Residential Structures	24,769	0.017	Implicit Deflator, ACN
5. Inventories	7,683	----	Investment: Implicit Deflator, ACN Asset: Wholesale price index
6. Land	11,843	----	Implicit Deflator assuming a constant stock

* ACN refers to Annuario di Contabilita Nazionale, 1973, Istituto Centrale di Statistica, Rome.

TABLE 8

ASSET PRICE INDEXES, 1952-1973

Year	1. Producer Durable Equipment	2. Non-Residential Structures	3. Residential Structures	4. Inventories	5. Consumer Durables	6. Land
1952	.942	.748	.708	.936	.827	.756
1953	.930	.758	.707	.932	.820	.761
1954	.896	.761	.735	.924	.842	.773
1955	.889	.782	.750	.932	.856	.785
1956	.906	.803	.771	.948	.886	.800
1957	.946	.819	.799	.957	.909	.819
1958	.939	.825	.799	.940	.929	.832
1959	.911	.831	.799	.912	.945	.847
1960	.915	.850	.824	.921	.955	.869
1961	.930	.875	.849	.923	.955	.895
1962	.948	.917	.917	.951	.979	.940
1963	1.000	1.000	1.000	1.000	1.000	1.000
1964	1.016	1.109	1.111	1.034	1.040	1.078
1965	1.029	1.152	1.117	1.050	1.045	1.114
1966	1.045	1.181	1.125	1.066	1.050	1.149
1967	1.054	1.223	1.161	1.064	1.060	1.201
1968	1.065	1.257	1.196	1.068	1.074	1.257
1969	1.090	1.353	1.304	1.110	1.093	1.364
1970	1.182	1.521	1.507	1.191	1.154	1.531
1971	1.299	1.611	1.587	1.231	1.221	1.628
1972	1.367	1.687	1.669	1.281	1.299	1.733
1973	1.570	1.976	1.980	1.416	1.417	2.010

The household sector is not subject to direct taxes on the capital service flow from its assets. Indirect taxation, however, is levied on the capital service flow in the form of property taxes. The capital service price for each asset in the household sector can be expressed as

$$q_{K,t} = q_{A,t-1}r_t + q_{A,t}\delta - \left(q_{A,t} - q_{A,t-1}\right) + q_{A,t}\tau_t$$

where $q_{K,t}$ is the service price, $q_{A,t}$ is the asset price, r_t is the rate of return or cost of capital, δ is the rate of depreciation, and τ_t is the rate of property taxation.

We assume that the rate of return is the same for all household assets. We have an estimate of property compensation for household owned residential structures and land. Thus we can equate this property compensation to the capital service price of residential structures times the lagged stock of residential structures plus the capital service price of land times the lagged stock of land. This gives us an equation where the household rate of return is the only unknown. Solving for the rate of return we have an expression in terms of property compensation, depreciation, revaluation, property taxes, and asset value, where each term is a sum for residential structures and land:

r_t = (Property compensation - property taxes - depreciation + revaluation)/ value of capital stock at the end of last period.

We assume that this rate of return is also applicable to owner-utilized consumer durables.

Given the rate of return for household sector assets, we can compute capital service prices for residential structures, land, and consumer durables. We construct a quantity index of household capital input as a Divisia index of the capital services for these three assets. Finally, we compute the implicit price for household sector capital input.

The derivation of capital service prices for assets held by the household sector must be modified for the business enterprise sector due to direct taxation of business property compensation. The general form for capital service price becomes

$$q_{K,t} = \left[\frac{1 - u_t z_t}{1 - u_t}\right] \left[q_{A,t-1} r_t + q_{A,t} \delta - \left(q_{A,t} - q_{A,t-1}\right)\right] + q_{A,t} \tau_t,$$

where u_t is the effective rate of direct taxation on business net income and z_t is the present value of depreciation allowances on a unit of new investment.[3] Depreciation allowances are different from zero only for durables and structures.

We assume that the rate of return is the same for all business assets. Thus we can equate total property compensation to the sum of each capital service price times the lagged capital stock of the corresponding asset. Substituting the capital service price formulas into this expression yields an equation where the rate of return is the only unknown. Solving for the rate of return yields the following expression:

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[3] See Hall and Jorgenson (1967), (1971) for derivation of these results.

r_t = (Property compensation - property taxes
- direct taxes - depreciation + revaluation)/
value of capital stock at the end of last period,
where each item is a sum for all six types of
business enterprise assets.

Our estimate of the effective rate of business enterprise direct taxes is obtained as the ratio of corporate income taxes plus all business profits and movable wealth taxes to business property income less taxes on business property and the imputed value of depreciation allowances for tax purposes. Imputed depreciation differs from depreciation for tax purposes in reflecting changes in the present value of future depreciation allowances as well as the current flow of depreciation allowances. The present value of depreciation deductions on new investment depends on depreciation formulas allowed for tax purposes, the lifetimes of assets used in calculating depreciation, and the rate of return. We assume that the rate of return used for discounting future depreciation allowances in the corporate sector is constant at ten percent. Based on information given in A. Anderson & Comaany's, Tax and Trade Guide, Italy we use straight-line depreciation and specify allowable lifetimes for depreciation as 6.67 years for producer durables, and 33.3 years for both residential and nonresidential structures.

We estimate the price of capital services for each asset employed in the business sector by substituting the business rate of return into the corresponding formula for the price of capital services. These formulas also depend on acquisition prices of capital assets, rates of replacement, and variables describing the tax structure. The quantity index of business capital input is computed as a Divisia index of the quantity of capital services for the five types of assets, where the weights are the relative shares of capital input in total business sector property compensation. Finally, we compute the implicit price for business sector capital input.

We construct the quantity index of capital input for the entire private domestic economy as a Divisia index of the quantity indexes of (1) household and (2) business enterprise capital input. The price index is computed as the ratio of total property compensation divided by the quantity index. In Table 9 we present the price and quantity indexes for capital input in the private domestic economy along with the index of aggregate capital stock and an index of capital input per unit of capital stock.

We construct the quantity index of total domestic business sector factor input as a Divisia index of the quantity indexes of (1) labor input and (2) capital input. The price index is computed as the ratio of total factor compensation divided by the quantity index. In Table 10 we present the price and quantity indexes of total factor input, as well as the relative share of property outlay in total factor outlay.

TABLE 9

GROSS PRIVATE DOMESTIC CAPITAL INPUT, 1952-1973 (CONSTANT LIRE of 1961)

Year	1. Private Domestic Capital Stock	2. Capital Input Per Unit of Capital Stock	3. Private Domestic Capital Input Price Index	4. Private Domestic Capital Input Quantity Index
1952	49586.1	.969	.087	48041.8
1953	50349.6	.972	.095	48945.7
1954	51468.3	.977	.092	50273.8
1955	52681.9	.980	.101	51650.6
1956	54506.7	.981	.105	53445.4
1957	56522.0	.982	.109	55511.0
1958	58742.2	.983	.113	57772.5
1959	60946.7	.983	.117	59935.2
1960	63536.7	.984	.123	62506.1
1961	66893.4	.987	.133	66022.2
1962	71027.9	.993	.139	70555.4
1963	75654.8	1.000	.139	75654.8
1964	80809.2	1.012	.138	81762.7
1965	84787.4	1.013	.139	85911.6
1966	88096.2	1.010	.151	89016.4
1967	91599.8	1.011	.158	92570.8
1968	96063.4	1.015	.162	97463.1
1969	100591.6	1.017	.179	102308.2
1970	105917.5	1.018	.178	107842.5
1971	111822.7	1.024	.157	114461.9
1972	116651.9	1.031	.164	120214.7
1973	121388.7	1.037	.188	125914.8

TABLE 10

GROSS DOMESTIC FACTOR INPUT, ITALY, 1952-1973 (CONSTANT LIRE of 1963)

Year	1. Gross Private Domestic Factor Input Price Index	2. Gross Private Domestic Factor Input Quantity Index	3. Property Compensation Relative Share
1952	.523	19141.2	.419
1953	.566	19637.5	.420
1954	.581	20240.2	.394
1955	.631	20505.9	.403
1956	.676	20774.1	.399
1957	.704	21482.7	.400
1958	.740	21890.2	.402
1959	.764	22525.4	.407
1960	.796	23619.2	.409
1961	.848	24696.4	.416
1962	.925	25601.8	.415
1963	1.000	26959.5	.389
1964	1.085	27334.5	.379
1965	1.163	26772.0	.385
1966	1.219	27766.6	.396
1967	1.289	29058.8	.390
1968	1.340	30230.5	.391
1969	1.468	30903.8	.404
1970	1.590	32253.1	.374
1971	1.658	32757.4	.332
1972	1.793	33170.6	.331
1973	2.114	34067.2	.329

5. Manhour Productivity and Total Factor Productivity

The most commonly employed measure of productivity is the ratio of real output to total manhours of labor input. This measure has the virtue of simplicity but the defect that it may be very poorly related to our view of increases in productivity as increases in the efficiency of the production process. A more satisfactory measure of economic efficiency is total factor productivity, the ratio of real output to a quantity index of the input of all productive factors. In Table 11 we present estimates of manhour productivity and total factor productivity for the Italian economy. Manhour productivity is the ratio of our quantity index of domestic business production to total manhours. For ease of comparison we normalized this ratio to 1.0 in 1963. Total factor productivity is the ratio of our quantity indexes of domestic business production and domestic business factor input derived in Sections 3 and 4, respectively.

For purposes of comparison we present two alternative estimates of total factor productivity in Table 12. The first variant of total factor productivity is based on the work of Denison (1962), (1967), which does not take into account the impact of changes in the composition of the aggregate capital stock on factor input. Thus we compute an alternative quantity index of total factor input as a Divisia index of labor input and the aggregate capital stock. The second variant of total factor productivity is based on the work of Solow (1960), which does not take into account changes in the composition of the aggregate capital stock or the labor force. Thus we

TABLE 11

MANHOUR AND TOTAL FACTOR PRODUCTIVITY, ITALY,
1952-1973 (1963 = 1.000)

Year	Manhour Productivity	Total Factor Productivity
1952	.608	.718
1953	.646	.763
1954	.649	.768
1955	.704	.823
1956	.741	.851
1957	.754	.861
1958	.796	.894
1959	.832	.927
1960	.845	.943
1961	.905	.981
1962	.970	1.005
1963	1.000	1.000
1964	1.087	1.020
1965	1.227	1.078
1966	1.280	1.098
1967	1.341	1.129
1968	1.405	1.146
1969	1.521	1.192
1970	1.583	1.204
1971	1.592	1.154
1972	1.685	1.172
1973	1.802	1.213

TABLE 12

TOTAL FACTOR PRODUCTIVITY, ITALY, 1952-1973
(1963 = 1.000)

Year	Labor Services and Capital Stock	Man Hours and Capital Stock
1952	.708	.672
1953	.755	.717
1954	.760	.724
1955	.816	.778
1956	.845	.806
1957	.855	.817
1958	.888	.850
1959	.921	.883
1960	.937	.899
1961	.975	.949
1962	1.002	.988
1963	1.000	1.000
1964	1.025	1.040
1965	1.083	1.115
1966	1.103	1.151
1967	1.134	1.200
1968	1.153	1.238
1969	1.200	1.307
1970	1.212	1.340
1971	1.165	1.307
1972	1.185	1.351
1973	1.229	1.423

compute an alternative quantity index of total factor input as a Divisia index of manhours (unadjusted for educational attainment) and capital stock. The resulting two variants of total factor productivity are presented in Table 12. It is clear that failure to account for compositional changes of labor or capital input have a substantial impact on estimates of total factor productivity.

Returning to our preferred measurement of total factor productivity, we note that we can represent the input of capital and labor services as products in terms representing the quality of capital and labor and the quantity of capital and labor:

$$K_s = q_K K_A, \qquad L_s = q_L L_A ,$$

when K_s is the input of capital services, K_A is aggregate capital stock, L_s is the input of labor services, and L_A is the "stock" of manhours used in production. The ratios K_S/K_A and L_S/L_A indicate the quality of K_A and L_A in the sense of services provided per unit of stock. These ratios will change as a result of compositional changes in the stock. They are presented in Table 13, normalized to 1.0 in 1963 for comparison. The labor quality index of L is of course the index of educational attainment described in Section 4.

Our measure of total factor productivity assumes that production in the domestic business economy can be closely approximated by the relation

$$Y^* = A^* + \bar{W}_K K_S^* + \bar{W}_L L_S^* ,$$